UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/866,313	05/24/2001	Anisul Khan	AM 5230	4319

32588 7590 08/27/2003

APPLIED MATERIALS, INC.
2881 SCOTT BLVD. M/S 2061
SANTA CLARA, CA 95050

EXAMINER
DEO, DUY VU NGUYEN

ART UNIT	PAPER NUMBER
1765	12

DATE MAILED: 08/27/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/866,313	KHAN ET AL.	
	Examiner	Art Unit	
	DuyVu n Deo	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 March 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2 and 4-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2 and 4-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

2. Claims 1, 5 are rejected under 35 U.S.C. 102(b) as being anticipated by Savas (US 5,983,828).

Savas describes a method for etching silicon comprising: anisotropically etching openings in silicon with sulfur hexafluoride etchant (col. 8, line 23-25) in a plasma etching chamber with a powered substrate support while pulsed bias power is applied to the substrate support electrode during the etch step (col. 4, line 1-4; col. 5, line 3-13, line 37-59; col. 7, line 55-60;

Referring to claim 5, the pulsed bias power is applied at a duty cycle of 5-50% (col. 12, line 10, 11). This would include claimed of 35%.

3. Claims 1 are rejected under 35 U.S.C. 102(e) as being anticipated by Wang et al. (US 6,593,244).

Wang describes a method for etching silicon comprising: anisotropically etching openings in silicon with sulfur hexafluoride etchant (col. 1, line 56-66; col. 3, line 14) in a plasma etching chamber with a powered substrate support while pulsed bias power is applied to the substrate support electrode during the etch step (col. 3, line 32-35).

Referring to claims 4 and 5, the duty cycle is from 10-99% and a period from 1 microsecond-900 milliseconds. These would include claimed 10-80% or 35% of duty cycle and 6-microsecond period.

Referring to claims 6, 8, 9 and 10, the method include deposition step using fluorocarbon prior to etching step with no bias power and a pressure of 40 mtorr (col. 3, line 1-11).

Referring to claim 11, there is no oxygen applied during the etching step (col. 3, line 12-15).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 2 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Savas.

Referring to claim 4, Savas describes the pulsed bias power is from 3-100 watts and the pulsed bias power is applied at a duty cycle of 5-50% (col. 12, line 10, 11). He doesn't describe the pulsed bias power is applied using a 6 microsecond period. However, the bias power and the period of applying the pulsed bias power would be result-effective variables and must be determined through routine experimentation in order to provide an optimum period for applying of pulsed bias power to etch the silicon with a reasonable expectation of success.

6. Claims 6-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Savas as applied to claim 1 above, and further in view of admitted prior art.

Unlike claimed invention, claims 6-9, Savas doesn't describe a deposition step prior to the etching step using a pressure of 5-300 mtorr and no bias power and overetch deposition and overetch steps are carried out after the etching step. Admitted prior art teaches a conventional method of etching silicon comprising a deposition step prior to etching step using a pressure of 18 mtorr and overetch deposition and overetch steps are carried out after the etching step. There is no bias power applied during the deposition step and the overetch step would remove any

debris from the bottom of the opening (pages 1-2 of he specification). It would have been obvious for one skill in the art to modify Savas in light of admitted prior art because it teaches the other steps of a conventional etching method for silicon where the deposition would protect the photoresist pattern. Further more a overetch deposition and etching would help to etch the silicon to a desired depth with a reasonable expectation of success.

Referring to claim 11, Savas uses etchant of SF6/Ar would read on claimed of etching is carried out in the absence of oxygen (col. 8, line 23-25).

Referring to claims 12, and 13, it would be obvious for one skill in the art to apply pulsed bias power during the overetch step because he teaches that it would cause anisotropic etching of the substrate (col. 4, line 1-5; col. 5, line 37-59).

7. Claims 7, 12, 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang as applied to claims 1 and 6 above, and further in view of admitted prior art.

Unlike claimed invention, claims 6-9, Wang doesn't describe overetch deposition and overetch steps are carried out after the etching step. Admitted prior art teaches a conventional method of etching silicon comprising overetch deposition and overetch steps are carried out after the etching step. The overetch step would remove any debris from the bottom of the opening (pages 1-2 of he specification). It would have been obvious for one skill in the art to modify Savas in light of admitted prior art because it teaches the other steps of a conventional etching method for silicon. Further more a overetch deposition and etching would help to etch the silicon to a desired depth with a reasonable expectation of success.

Referring to claims 12, and 13, a pulsed bias power applied during the overetch would be obvious because as Wang teaches that it would reduce notching of silicon (col. 3, line 37-40).

Double Patenting

8. Claims 1, 2, 4, 5 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 6-9, 11, 12 of U.S. Patent No. 6,593,244 in view of Savas (US 5,983,828).

The claims of patent 6,593,244 describes etching of a silicon comprising: anisotropically etching openings in silicon with fluorine containing gas in a plasma etching chamber with a powered substrate support while pulsed bias power is applied to the substrate support electrode during the etch step. Unlike claimed invention, the claims of patent 6,593,244 do not describe using a fluorine containing gas such as SF6 to etch the silicon. However it is well known to one skill in the art to etch silicon with SF6 as shown here by Savas (col. 8, line 23-25). Therefore, it would have been obvious for one skill in the art to etch silicon using SF6 because Savas further describes the fluorine containing gas suggested by claims of patent 6,593,244 to etch silicon with a reasonable expectation of success.

Referring to claim 2, the bias power would be a result-effective variable and must be determined through routine experimentation in order to provide an optimum power to etch the silicon with a reasonable expectation of success.

Referring to claims 4 and 5, the duty cycle is from 10-99% and a period from 1 microsecond-900 milliseconds. These would include claimed 10-80% or 35% of duty cycle and 6 microsecond period.

9. Claims 6-13 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 6-9, 11, 12 of U.S. Patent No. US 6,593,244 in view of Savas and admitted prior art.

Unlike claimed invention, claims 6-9, the claims of patent 6,593,244 do not describe a deposition step prior to the etching step using a pressure of 5-300 mtorr and no bias power and overetch deposition and overetch steps are carried out after the etching step. Admitted prior art teaches a conventional method of etching silicon comprising a deposition step prior to etching step using a pressure of 18 mtorr and overetch deposition and overetch steps are carried out after the etching step. There is no bias power applied during the deposition step and the overetch step would remove any debris from the bottom of the opening (pages 1-2 of he specification). It would have been obvious for one skill in the art to modify the claims of patent 6,593,244 in light of admitted prior art because it teaches the other steps of a conventional etching method for silicon where the deposition would protect the photoresist pattern. Further more a overetch deposition and etching would help to etch the silicon to a desired depth with a reasonable expectation of success.

Referring to claim 11, Savas uses etchant of SF6/Ar would read on claimed of etching is carried out in the absence of oxygen (col. 8, line 23-25).

Referring to claims 12, and 13, it would be obvious for one skill in the art to apply pulsed bias power during the overetch step because Savas teaches that it would cause anisotropic etching of the substrate (col. 4, line 1-5; col. 5, line 37-59).

Claim Objections

10. Claims 8 and 10 are objected to because of the following informalities: they are the same and depending on the same claim. Appropriate correction is required.

Claim Rejections - 35 USC § 112

11. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

12. Claim 13 recites the limitation "the overetch step". There is insufficient antecedent basis for this limitation in the claim.

13. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

14. Claims 11-13 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Applicant has not shown where in the specification describes the etching is carried out in the absence of oxygen, and the pulsed bias power is applied during the overetch step.

Conclusion

15. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 703-305-0515.

DVD
8/25/03

NADINE G. NORTON
PRIMARY EXAMINER